temperature, and the amount of heat available. The only actuators for control may be the switching times and durations of the relaxation and heat driven modes. Automation of the process can occur using a real-time optimized controller using a low-power embedded computer with cellular connectivity, such as the Raspberry Pi and/or Particle Electron, to allow remote control and data logging of operational units worldwide.

What is claimed is:

1. A distillation system, comprising:

a plurality of operatively connected open-cycle adsorption stages, each stage comprising:

a plurality of operatively connected beds; and

an evaporator and a condenser operatively connected to a first bed of

the plurality of beds and a second bed of the plurality of beds;

a switchable heat source configured to provide heat to one of the plurality of operatively connected beds in one of the plurality of operatively connected open-cycle adsorption stages only during a first operating phase; and

a switchable heat exhaust configured to remove heat from another of the plurality of operatively connected beds in one of the plurality of operatively connected open-cycle adsorption stages only during the first operating phase;

wherein each bed comprises at least a first, second, and third vapor valve, at least one hollow tube, at least one channel adapted for transferring water vapor to and from at least one of the condenser or the evaporator, a thermally conductive water vapor adsorbent, and

wherein the first vapor valve connects the bed to the condenser, the second vapor valve connects the bed to the evaporator, and the third vapor valve connects a volume inside the hollow tubes of the first bed with a volume inside the hollow tubes of the second bed.

2. The distillation system of claim **1**, wherein each evaporator and condenser is shared between the first bed and second bed of each of the respective stage.

3. The distillation system of claim **1**, wherein the hollow tubes are comprised of at least one material selected from the group of copper, aluminum, or steel, the thermally conductive water vapor adsorbent is comprised of silica gel, at least one material selected from the group of calcium chloride, lithium bromide, or lithium chloride, and a plurality of graphite nanosheets, having between about 1 and about 100 carbon atom planes in thickness, and having a characteristic diameter of less than 300 microns.

4. The distillation system of claim **1**, wherein a volume in the first bed is a volume defined as the sum of the volume inside the hollow tubes of the first bed plus the volume of a vapor plenum;

wherein the third vapor valve is adapted for allowing controlled vapor flow and heat transfer between beds; wherein the volume in the first bed can be evacuated of non-condensable gases and selectively filled or drained of a volatile fluid to allow the volume to generate or condense vapor, respectively;

wherein heat from adsorbent conducted through the hollow tube wall into the volume of the first bed vaporizes at least some of the volatile fluid, in which the vaporized fluid is transmitted and condensed in the volume within a second bed or to the heat exhaust at a lower temperature;

and wherein alternatively, vapor generated from a second bed or the heat source at a higher temperature flows into the volume of the first bed and condenses, conducting heat out of the volume through the hollow tube wall and into adsorbent.

5. The distillation system of claim **1**, wherein the operational range in temperature and adsorbed water uptake for each bed is selected, based on the physical equilibrium properties of the adsorbent, to correspond with the saturated vapor partial pressure of the input solution at a particular temperature; the resultant operational temperature ranges of all beds of all stages forming a continual sequence between the temperatures of the heat source and the heat exhaust.

6. The distillation system of claim **1**, further comprising a pre-deaeration unit that receives an input liquid, and outputs a deaerated liquid to the first open-cycle adsorption stage.

7. The distillation system of claim **1**, further comprising at least one heat exchanger for transferring heat between fluid entering at least one evaporator and at least one fluid exiting from at least one component selected from the group consisting of a condenser or an evaporator.

8. The distillation system of claim **1**, further comprising an electrical power source.

9. The distillation system of claim **8**, wherein the power source comprises a plurality of solar cells.

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